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10/804,485	03/18/2004	Uday R. Naik	42P17962	7586

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EXAMINER	
WONG, WARNER	
ART UNIT	PAPER NUMBER
2616	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/804,485	NAIK ET AL.	
	Examiner	Art Unit	
	WARNER WONG	2616	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 April 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7,9-22 and 24-28* is/are rejected.

7)☒ Claim(s) *8 and 23* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims 1-6, 10-12, 25, 27-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kumar (US 2004/0028040) in view of Raghunandan (US 2004/0264479).

Regarding claim 1, Kumar describes a method, comprising:

receiving a packet at a network device, the packet including a destination address (para. 22);

indexing into a table using a portion of the destination address to locate an entry in the table associated with the portion of the destination address (para. 32, indexing a trie data structure 500 (table) entry using device address prefix);

deriving a pool index associated with the portion of the destination address to identify a pool of data blocks from among a plurality of pools of data blocks in the same memory unit (para. 31-32, index to trie entry which identifies the subsequent search trees (pool of data blocks), all trie entries are ultimately stored in memory unit 240, para. 28);

navigating the entry and the pool of data blocks that is identified to find a next-hop for the packet (para. 33, trie data structure 500 and associated information 600 is used to determine the route pointer 602).

Kumar describes using trie form, but fails to explicitly describe: each trie block comprises a plurality of trie entries, each trie entry comprising a next hop pointer and a next trie pointer to reference trie entries located in the pool of trie blocks including the next-hop pointer and next-trie pointer.

Raghunandan describes: each trie block comprises a plurality of trie entries, each trie entry comprising a next hop pointer and a next trie pointer to reference trie entries located in the pool of trie blocks including the next-hop pointer and next-trie pointer (para. 5-6, routing table implemented in trie form, where trie blocks with trie entries, each entry points to (comprises) a next hop pointer and a next trie pointer to further reference entries within the set (pool of) of tries blocks, see also fig. 1 & 2).

It would have been obvious to one with ordinary skill in the art at the time of invention by applicant to describe the trie form with the above details as in Raghunandan for the trie used in Kumar.

The motivation for combining the teachings is that it allows the packet's next hop to be determined (Raghunandan, para. 3).

Regarding claim 10, Kumar describes a method, comprising:

receiving a packet at a router, the packet including a destination internet protocol (IP) address (para. 22);

indexing into a table comprising a plurality of trie entries using a portion if the destination IP address to find a trie entry of the plurality of trie entries (para. 30-31, indexing trie table's entries using the destination address's prefix bits), wherein each trie entry comprises 64-bits (para. 64-65, trie entry has 64 bits to compares with the IPv6's 64 bits destination address);

deriving a pool index associated with the portion of the destination address to identify a pool of data blocks from among a plurality of pools of data blocks in the same memory unit (para. 31-32, index to trie entry which identifies the subsequent search trees (pool of data blocks), all trie entries are ultimately stored in memory unit 240, para. 28);

navigating the trie entry and the pool of trie blocks that is identified to follow the trie entry to find a next-hop for the packet (para. 32-33, trie lookup algorithm determines the transmitted next hop).

Kumar describes using trie form, but fails to explicitly describe: each trie block comprises a plurality of trie entries, each trie entry comprising a next hop pointer and a next trie pointer to reference trie entries located in the pool of trie blocks including the next-hop pointer and next-trie pointer.

Raghunandan describes: each trie block comprises a plurality of trie entries, each trie entry comprising a next hop pointer and a next trie pointer to reference trie entries located in the pool of trie blocks including the next-hop pointer and next-trie pointer (para. 5-6, routing table implemented in trie form, where trie blocks with trie entries, each entry points to (comprises) a next hop pointer and a next trie pointer to further reference entries within the set (pool of) of tries blocks, see also fig. 1 & 2).

It would have been obvious to one with ordinary skill in the art at the time of invention by applicant to describe the trie form with the above details as in Raghunandan for the trie used in Kumar.

The motivation for combining the teachings is that it allows the packet's next hop to be determined (Raghunandan, para. 3).

Regarding claim 25, Kumar describes a network device, comprising:

a plurality of ports (fig. 1, network device 120 has ports to end devices 122);

a processor communicatively coupled to each of the plurality of ports (fig. 2, controller (processor) within the network device 200);

a storage device operatively coupled to the processor (fig. 2, local cache 232 & memory unit 240), the storage device including a plurality of instructions which when executed by the processor perform operations comprising:

receiving a packet at a first port of the plurality of ports, the packet including a destination address (para. 22);

indexing into a table using a portion of the destination address to locate an entry in the table associated with the portion of the destination address (para. 32, indexing a trie data structure 500 (table) entry using device address prefix);

deriving a pool index associated with the portion of the destination address to identify a pool of trie blocks from a plurality of pools of trie blocks in the same memory unit (para. 31-32, index to trie entry which identifies the subsequent search trees (pool of data blocks), all trie entries are ultimately stored in memory unit 240, para. 28);

navigating the entry and the pool of trie blocks to find a next-hop for the packet (para. 33, trie data structure 500 and associated information 600 is used to determine the route pointer 602);

outputting the packet from a second port of the plurality of ports to the next-hop (para. 13, network device 120 output packet to the port directed to the respective destination device 132).

Kumar describes using trie form, but fails to explicitly describe: each trie block comprises a plurality of trie entries, each trie entry comprising a next hop pointer and a next trie pointer to reference trie entries located in the pool of trie blocks including the next-hop pointer and next-trie pointer.

Raghunandan describes: each trie block comprises a plurality of trie entries, each trie entry comprising a next hop pointer and a next trie pointer to reference trie entries located in the pool of trie blocks including the next-hop pointer and next-trie pointer (para. 5-6, routing table implemented in trie form, where trie blocks with trie entries, each entry points to (comprises) a next hop pointer and a next trie pointer to further reference entries within the set (pool of) of tries blocks, see also fig. 1 & 2).

It would have been obvious to one with ordinary skill in the art at the time of invention by applicant to describe the trie form with the above details as in Raghunandan for the trie used in Kumar.

The motivation for combining the teachings is that it allows the packet's next hop to be determined (Raghunandan, para. 3).

Regarding claims 2 and 11, Kumar further describes that an entry in the table comprises a next-hop pointer and a next-trie pointer (fig. 6, entry comprising route pointer & next trie pointer).

Regarding claim 3, Kumar further describes: each data block of the pool of data blocks comprises a plurality of data entries, each data entry of the plurality of data entries comprises a next-hop pointer and a next-trie pointer (para. 32, each trie search tree subset (data block of the pool of data blocks) comprises a plurality of data entries, where entries are depicted in fig. 6).

Regarding claims 4 and 12, Kumar further describes:

navigating the entry and the pool of trie blocks comprises: updating a next-hop-to-return with the next-hop pointer if the next-hop pointer is not null (para. 33, updating current router pointer (next-hop-to-return) if extracted route pointer 602 is not null);

following the next-trie pointer to a trie block within the pool if the next-trie pointer is not null and indexing into the trie block with a second portion of the destination address (fig. 5 & para. 34, indexing subsequent non-null trie tree entries using different destination address prefix bits); and following the next-hop-to-return to a next-hop table if the next-trie pointer is null (para. 32, current router pointer (next-hop-to-return) remains unchanged if next-trie pointer is null).

Regarding claims 5 and 27, Kumar further describes: deriving the pool index comprises performing a hash on the portion of the destination address to obtain the pool index (para. 19, use hashing to perform the search, fig. 2, hashing unit).

Regarding claim 6, Kumar and Raghunandan combined further suggest:

deriving the pool index comprises reading the pool index associated with the portion of the destination address from the entry in the table, wherein the pool index is a separate field in addition to a next-hop pointer and next-trie pointer in the entry in the table (Raghunandan, para. 7, (pool) index to the second portion which is associated with the destination address is separately value (field) to the entry's next-hop pointer and next-trie pointer).

Regarding claim 28, Kumar further suggests: deriving the pool index comprises reading the pool index associated with the portion of the destination address from the

entry in the table (para. 31-32, reading latter prefix bits associated with the destination address at the point when third table entry is addressed, see fig. 5).

2. Claims 7 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kumar in view of Raghunandan, and further in view of Du (US 5,694,591).

Regarding claim 7, Kumar describes a trie structure (table) where each entry is indexed by a portion of a particular destination address, but fails to describe:

examining the plurality of pools of trie blocks to find an under-utilized pool;

adding a second entry to the table indexed by a portion of a second destination address, a second pool index associated with the portion of the second destination address to correspond to the under-utilized pool.

Du describes a tree balancing method comprising:

examining the plurality of pools of trie blocks to find an under-utilized pool (col. 8, lines 53-67, comparing the deep-left (potential overflow pool) branching costs in balancing a tree from fig. 1 to fig. 2);

adding a second entry to the table a second pool index to correspond to the under-utilized pool (col. 8, lines 1-9, ship/relocate tuples (add entries with indices to the right-branching (under-utilized pool) in transforming the data structure into a “balanced bushy tree”)).

It would have been obvious to one with ordinary skill in the art at the time of invention by applicant to utilize the scheme of Du to resolve imbalance tree structures (with under-utilized pool) for the tree structure stored for routing purposes of Kumar.

The motivation for combining the teachings is that costs may be equalized within the search tree, resulting an optimal query response time (col. 5, lines 14-19 & 25-31).

Regarding claim 9, Kumar describes a trie structure (table) where each entry is indexed by a portion of a particular destination address, but fails to describe:

examining the plurality of pools of trie blocks to find a potential overflow pool;

adding a second entry to the table indexed by a portion of a second destination address, a second pool index associated with the portion of the second destination address not to be associated with the potential overflow pool.

Du describes:

examining the plurality of pools of trie blocks to find a potential overflow pool (col. 8, lines 53-67, comparing the deep-left (potential overflow pool) branching costs in balancing a tree from fig. 1 to fig. 2);

adding a second entry to the table indexed by a portion of a second destination address, a second pool index associated with the portion of the second destination address not to be associated with the potential overflow pool (col. 8, lines 1-9, ship/relocate tuples (add entries with indices to the right-branching (not associated with

the potential overflow pool) in transforming the data structure into a "balanced bushy tree")).

3. Claims 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kumar in view of Du and Mathew (US 2004/0006639).

Regarding claim 13, Kumar describes a method, comprising:

receiving a packet at a network device, the packet including a destination internet protocol (IP) address (para. 22-23, IPv6 packet with destination address);

indexing into a table comprising a plurality of trie entries using a portion of the destination address to find an entry of the plurality of trie entries (para. 32, indexing into trie data structure 500 (table) using device address prefix), wherein each trie entry in the table comprises a next-hop pointer and a next-trie pointer (para. 33, trie data structure 500 and associated information 600 is used to determine the route pointer 602).

deriving a pool index associated with the portion of the destination address to identify a pool of trie blocks from a plurality of pools of trie blocks in the same memory unit (para. 31-32, index to trie entry which identifies the subsequent search trees (pool of data blocks), all trie entries are ultimately stored in memory unit 240, para. 28);

navigating the entry and the pool of trie blocks that is identified to find a next-hop for the packet (para. 33, trie data structure 500 and associated information 600 is used to determine the route pointer 602 to route packet);

Kumar describes using trie form, but fails to explicitly describe: each trie block comprises a plurality of trie entries, each trie entry comprising a next hop pointer and a next trie pointer to reference trie entries located in the pool of trie blocks including the next-hop pointer and next-trie pointer.

Raghunandan describes: each trie block comprises a plurality of trie entries, each trie entry comprising a next hop pointer and a next trie pointer to reference trie entries located in the pool of trie blocks including the next-hop pointer and next-trie pointer (para. 5-6, routing table implemented in trie form, where trie blocks with trie entries, each entry points to (comprises) a next hop pointer and a next trie pointer to further reference entries within the set (pool of) of tries blocks, see also fig. 1 & 2).

It would have been obvious to one with ordinary skill in the art at the time of invention by applicant to describe the trie form with the above details as in Raghunandan for the trie used in Kumar.

The motivation for combining the teachings is that it allows the packet's next hop to be determined (Raghunandan, para. 3).

Kumar also describes route (next-hop) pointer and next trie pointer (fig. 6), but fails to describe: the next-trie pointer comprising more bits than the next-hop pointer.

Mathew describes: the next-trie pointer comprising more bits than the next-hop pointer (fig. 7 & para. 39, next trie is a 16-bit pointer whereas the next hop is a 15 bit pointer).

It would have been obvious to one with ordinary skill in the art at the time of invention by applicant to specify that the next trie pointer comprises more bits than the next-hop pointer as in Mathew for the trie entries in Kumar.

The motivation for combining the teachings is that it reduces the search and update times for routing information that may result in a faster processing of packets (Mathew, para. 1)

Regarding claim 14, Kumar and Mathew combined describes:

the next-hop pointer comprises 8-bits and the next-trie pointer comprises 24-bits (Mathew, para. 39, variations of 32 bits total may comprise 8-bit next hop and 24-bit next-trie).

Claim 15 comprises all limitations in claim 4. Hence it is rejected under the same rationale.

Claim 16 is an article of manufacture comprising the method as described in claim 1. Hence it is rejected under the same rationale.

Claims 17-22 and 24 are dependent claims comprising limitations described in claims 2-7 and 9 respectively. Hence, it is rejected under the same rationale.

4. **Claim 26** is rejected under 35 U.S.C. 103(a) as being unpatentable over Kumar as applied to claim 25 above, and further in view of Choe (US 2002/0118682).

Kumar describes a plurality of pools of trie blocks (fig. 5, subset of trie search branches), but fails to describe:

the trie blocks are stored as a link list in a memory device operatively coupled to the processor (para. 51 & 55, the trie lookup structure in a linked list format).

It would have been obvious to one with ordinary skill in the art at the time of invention by applicant to use a linked list format for storing trie lookups as in Choe for the system of Kumar.

The motivation for combining the teachings is that it provides a method for performing high-speed IP route lookups and managing routing/forwarding tables (Choe, para. 17).

Allowable Subject Matter

5. **Claims 8 and 23** objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: The prior art fails to describe a routing table lookup <u>further</u> comprising the limitations of:

"splitting the under-utilized pool into a first pool of data blocks and a second pool of data blocks."

Response to Arguments

6. Applicant's arguments with respect to claims 1-28 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: Kunze (US 2003/0058860) describing destination address filtering, Hooper (US 2004/0052254) describing a distributed lookup based on packet contents, Basu (US 7,356,033) describing a method and apparatus for performing network routing, Joung (US 2004/0170170) describing a packet classification apparatus and method, Mehrotra (US 2004/0052251) describing a method for fast binary network address lookups, Shadmon (US 2008/0071733) describing an efficient traversals of hierarchical data and indexing, and Mehrotra (US 6,985,483) describing methods for fast packet forwarding.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to WARNER WONG whose telephone number is (571)272-8197. The examiner can normally be reached on 6:30AM - 3:00PM, M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kwang Yao can be reached on 571-272-3182. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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